Nov. 14, 1967 G. J. MELCHER 3,352,604

METHOD AND APPARATUS FOR MAKING BRUSH SEGMENTS

Original Filed Dec. 28, 1961 2 Sheets-Sheet 1

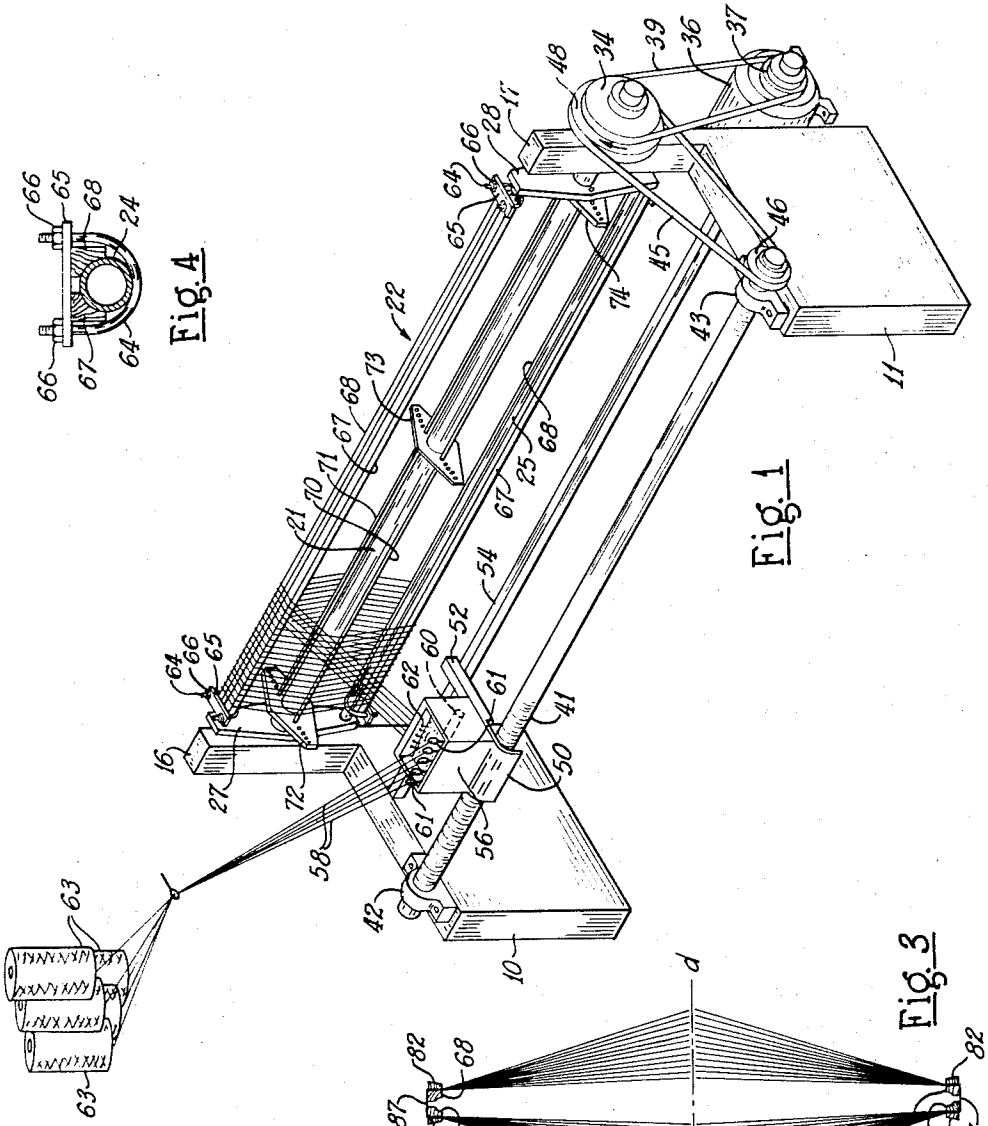


Fig. 1

Fig. 4

Fig. 3

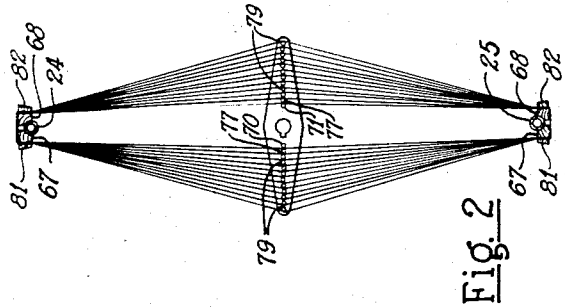


Fig. 2

INVENTOR.
GLEE J. MELCHER
BY Staelin & Overman
ATTORNEYS

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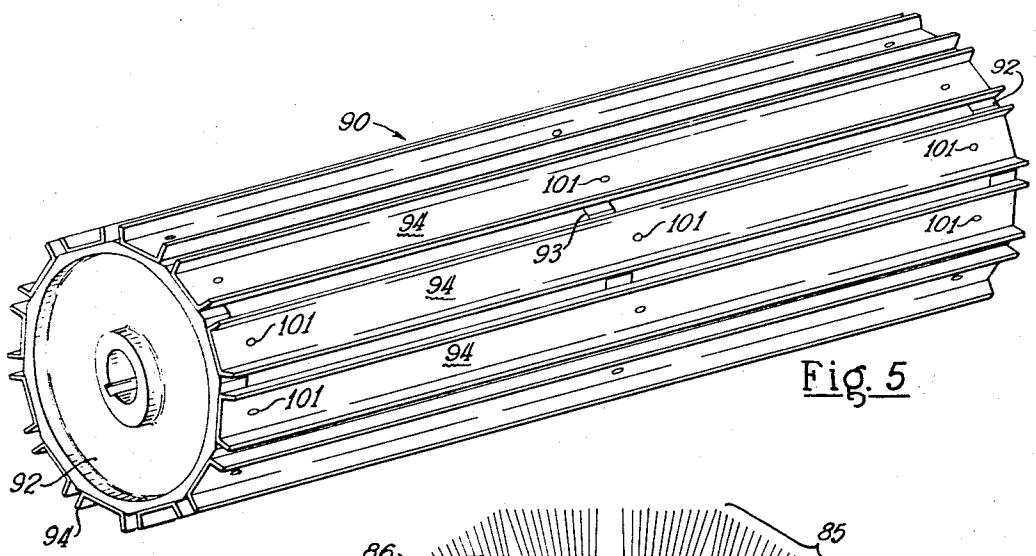


Fig. 5

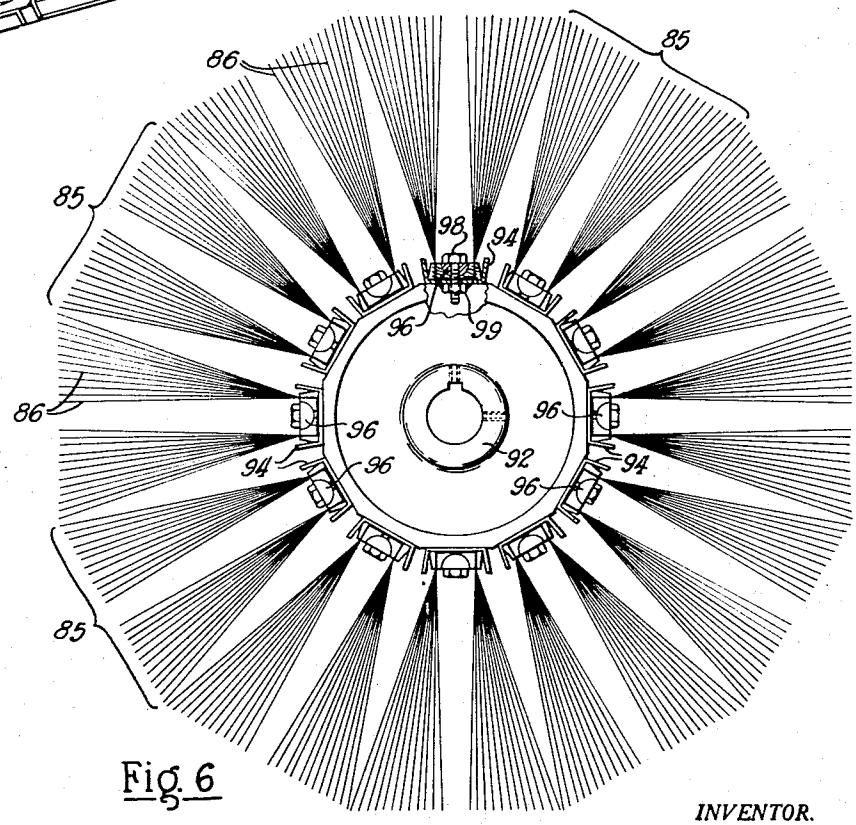


Fig. 6

INVENTOR.
GLEE J. MELCHER
BY
Stachin & Quenman
ATTORNEYS

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METHOD AND APPARATUS FOR MAKING BRUSH SEGMENTS

Glee J. Melcher, Spokane, Wash., assignor to Owens-Corning Fiberglas Corporation, a corporation of Delaware

Original application Dec. 28, 1961, Ser. No. 162,842, now Patent No. 3,233,270, dated Feb. 8, 1966. Divided and this application Oct. 24, 1965, Ser. No. 513,894
8 Claims. (Cl. 300—1)

This application is a division of my copending application Ser. No. 162,842, filed in the name of the present inventor on Dec. 28, 1961, and now patent No. 3,233,270, issued Feb. 8, 1966.

This invention relates to brooms and apparatus for making them.

More specifically the invention pertains to the fabrication of broom segments particularly adapted for assembling into a cylindrical broom or brush for street sweeping.

The invention further relates to broom bristles having a fibrous glass base and a heavy outer layer of plastic.

The majority of the machines for street cleaning utilize a large cylindrical broom revolving about a horizontal axis. These machines are generally pick-up sweepers in which the broom projects the debris upon a conveyor which carries it to a hopper.

Still in limited use is an older type of machine utilizing a similar cylindrical broom mounted at an angle to the direction of travel for sweeping the dirt into a windrow at the side of the pavement for subsequent collection.

Split hickory, bass, palmyra, split bamboo, steel and more recently synthetic fibers of nylon, polystyrene and polypropylene have been used for the bristles in these brooms.

The median life of these cylindrical brooms with vegetable fiber bristles has been between 200 or 300 curb miles, a distance easily covered within one week. Accordingly, the cost of a new broom and the labor cost of removal and replacement is incurred at frequent intervals. The loss of the use of the machine for the replacement operation requires additional equipment or delays the cleaning of streets.

Steel bristles are expensive, subject to corrosion, and are objectionable because of the broken metal pieces which are shredded and left behind. For air strip cleaning these metal remnants are particularly dangerous as they are apt to be drawn into the air take of jet aircraft.

The cost of the synthetic bristles is even higher than that of steel. Further, these bristles are of materials which are inclined to absorb water and are objectionable in this respect. They further do not generally have the desired flexibility.

An object of this invention is the provision of bristles of reasonable cost and which have a long life with uniform flexibility most advantageous for street sweeping.

More specifically, an object is to provide a method of making bristles of fibrous glass and a plastic overlay.

A further object is a method of coating fibrous glass strands with a fluid plastic, positioning the strands in bristle formation in a brush segment, and then setting the plastic coating of the strands.

Also an object of this invention is the provision of apparatus for coating fibrous glass strands while wrapping them traversely upon a rotating reel.

A further object is the provision of shaped brush segments in which the bristles are in fixed relation and in definite rows and a method of fabricating such brush segments.

An additional object is to provide brush segments facilitating original assembly and adapted for rapid replacement upon a brush core.

These as well as other objects and advantages are attained at least in part by coating fibrous glass rovings with a hardenable plastic resin just prior to winding the rovings upon a brush segment forming reel and setting the resin after the rovings have been so arranged.

The invention will be explained more completely hereafter in connection with the drawings in which:

FIGURE 1 is a perspective view of apparatus designed for creating brush segments according to the invention;

FIGURE 2 is an enlarged sectional view of a completed double brush segment on the apparatus of FIGURE 1;

FIGURE 3 is a sectional view of two brush segments formed from the double segment illustrated in FIGURE 2 after it has been sheared along its mid-section and removed from the apparatus;

FIGURE 4 is a sectional view on an enlarged scale of a clamping arrangement for holding brush backing strips on longitudinal members of the reel of the apparatus of FIGURE 1;

FIGURE 5 is a perspective view of a core adapted to receive the brush segments of this invention; and

FIGURE 6 is an end view of the core of FIGURE 5 with the brush segments mounted thereon.

Referring to the drawings in more detail the apparatus of FIGURE 1 includes a base formed of end blocks **10** and **11**. Two uprights **16** and **17** of the frame blocks provide bearing apertures for the center shaft **21** of a rotatable reel assembly **22**.

The reel has a pair of longitudinal members **24** and **25** slightly more than sixty inches in length and spaced twenty-four inches apart. These are cylindrical in form and are secured at their ends to cross pieces **27** and **28**. Cross pieces **27** and **28** are fixed to shaft **21**. On the outer end of shaft **21** projecting through upright **17** is a pulley **34** driven by motor **36** through motor pulley **37** and belt **39**. Through this drive the reel assembly **22** is rotated at the desired speed.

On the near side of the apparatus, as seen in FIGURE 1, is a double-threaded lead screw or cylindrical cam **41** rotatably journaled in bearings **42** and **43** supported on the frame blocks **10** and **11**. The lead screw **41** is turned by a belt **45** running between pulley **46** on the end of the lead screw and pulley **48** on the shaft **21** projecting through block **11**.

A carriage **50** has a pivotable lug (not shown) riding in the threading of the lead screw **41** and the carriage is moved lengthwise of the reel **22** by the continuous engagement of the lug with the lead screw. The carriage **50** is further supported by a lateral leg **52** which slides upon the rail **54** extending between frame members **10** and **11**. Mounted on the carriage **50** is a resin container **56**.

Rovings **58**, in this example five in number, are delivered from spools **63** and directed under a coating roller **60** within the resin container after passing through spaced guide eyes **61**. Exit guiding apertures **62** for the rovings remove excess resin therefrom.

Other structural features of the apparatus will be described in the subsequent explanation of the operation of the apparatus.

A preferred roving for the practice of the invention is one about .06 of an inch in diameter and made up of sixty ends of strand composed of continuous glass filaments with an average filament diameter of .00036 of an inch and each strand having 13,500 feet of length, per pound.

To provide compatability and good bonding characteristics between the roving and the resin, preferably utilized to coat the roving, the latter is finished with a chrome size. A well known type is a methacrylate chromic chloride complex, neutralized with ammonia.

As disclosed, five of the rovings **58** are drawn from spools **63**. They are led through guide eyes **61** and under the resin applicator roller **60** within the container **56**

which initially is at the left end of the lead screw **41**, as viewed in FIGURE 1. After being passed through the wiping guides **62** they are fastened to the end of one of the longitudinal members **24** or **25** of the reel **22** and are spaced apart about three-tenths of an inch.

Held at each end of the longitudinal members by a U-bolt **64**, strap **65** and nuts **66**, as best seen in FIGURE 4, are pairs of brush back forming strips **67** and **68** of arcuate cross section. These extend along opposite sides of the outer portion of each member **24** and **25**.

The preferred resin is a general purpose polyester (containing monomeric styrene, diallyl phthalate, or vinyltoluene as cross-linking agents) catalyzed for fast curing at room temperature. Such a resin is available at low cost and has the stiffness, strength, and resilience desired in a bristle for street sweeping.

The resin should be sufficiently viscous for each roving to pick up a resin coating of a weight approximately equal to that of the roving. In this case, this is a coating about .02 of an inch thick which increases the diameter of the roving to approximately one-tenth of an inch.

The reel **22** may be turned, for instance, at thirty revolutions a minute with the carriage driven at a speed whereby it makes a single traverse for every forty revolutions of the reel. This would space each turn of coated rovings about three-tenths of an inch apart, the same spacing existing between the five individual rovings of each set, as they are wrapped upon the reel.

After the full traverse of the carriage **50**, with the coated rovings wrapped around a five foot span of the reel, a rod or sticker about one-quarter of an inch in diameter is placed against each side of the wrapped form or shell of rovings alongside of the shaft **21** midway between the longitudinal members **24** and **25**. An original pair of such rods **70** and **71** may be so mounted before the wrapping of the rovings is initiated.

These rods are positioned through openings in spacers **72** and **74** fixed to the cross pieces **27** and **28** and through openings in a spacer **73** fastened to the shaft **21** at its center point. After a second pair of rods **77** are placed along the outside of the first wrapping of the rovings, reel **22** is again rotated and the carriage **50** with the resin container is moved in the opposite direction through the action of the lug on the carriage following the opposite threading of the lead screw **41**.

The second skein or layer of rovings formed by the second traverse of the carriage **50** is held about a quarter of an inch out from the first layer at the midpoint between the longitudinal members **24** and **25** by the pair of rods or stickers **77**. This spacing establishes the final row spacing arrangement of bristles in the brush.

After the second traverse of the resin carriage another pair of rods **79** are positioned through the spacers in the holes adjacent to those through which the pair **77** were inserted. This positions the next layer of rovings one-quarter of an inch out from the preceding layer.

For a total of thirteen traverses this procedure is repeated with additional pairs of rods **79** inserted after each traverse. In the resulting composite shell of coated rovings wrapped on the reel the rovings are closely contiguous or in contact with each other as they pass over the longitudinal members **24** and **25** but form thirteen strata diverging slightly from these members to a maximum spacing between strata of one-quarter of an inch midway between the members.

While the resin is still sticky two narrow reinforcing wooden slats **81** and **82** are attached at the sides of the narrow ends of the shell of rovings outside of the location of the back forming pieces **67** and **68**. A cross section of the reel with the roving shell forming a double brush segment thereon is shown in FIGURE 2.

The plastic resin is allowed to harden and then rods **77** and **79** are removed by drawing them out lengthwise through the apertures of spacers **72**, **73** and **74**. The rods are waxed or carry some other releasing coating which

prevents the resin from adhering to them. To form two broom segments the shell or double segment is cut by shears along both sides of the line *d—d*, shown in FIGURE 3, and the two brush segments **85** may then be removed from the reel and appear as illustrated in FIGURE 3.

The resulting five foot long brush segments **85** with bristles twelve inches in length have a continuous film of hardened resin between and imbedding the rovings around the base **87** of each segment. This is thick enough to have considerable strength to bond the bristles together and to hold the shape of the segment. The strips **67** and **68** and slats **81** and **82** are also held firmly in place by this resin film and cooperate with it in serving as the brush backing or base **87**.

A brush or broom core **90** particularly adapted for receipt of twelve of the brush segments **85** is illustrated in FIGURE 5. It has hubs **92** bored for receipt of mounting and driving shafts for rotating the brush assembly. Extending lengthwise of the core and welded to the hubs **92** and to a center reinforcing wheel **93** are twelve outwardly facing channels **94**. These are dimensioned to receive the bases of the brush segments. To hold the latter firmly in proper positioning, retaining bars **96** of semi-cylindrical form are fitted against the curved portions of the strips **67** and **68**. These are tightened in place by bolts **98** passed through the bars **96**, the resin film backing of the brush segments and holes **101** in the channels **94**. The bolts are threaded into nuts **99** welded to the underside of the channels.

The features of the invention include the traversing of the combination roving feeder and coater, the positioning of the coated roving rows in final bristle arrangement and setting the resin thereafter, the creation of a heavy, reinforcing, continuous resin film at the base of each segment, polyester coated glass strands of brush bristles and the brush segment design and assembly upon a brush core.

The glass strand utilized for the bristle base may of course be of various structures and sizes other than the rovings prescribed herein. With a lighter roving, closer spacing of the bristles of each row and of the rows themselves would be desirable. The term "strand" is utilized in the claims to indicate any fibrous glass roving, yarn, strand or cord that might serve as a bristle base.

Other resins than polyester would be quite as adequate. These could be either thermosetting or thermoplastic. In the prescribed quantity and viscosity of resin applied to the strands any of such resins should merge to form a continuous, solid film encasing the contiguous glass strands at the base of each brush segment. The consolidation of plastic resin and glass strands in this area creates, in effect, a plastic backing reinforced with glass strands.

While a reel rotatable on a horizontal axis is considered the most feasible arrangement for practicing the invention, the reel could, of course, be mounted for rotation on a vertical axis or one inclined to the horizontal. The grinding of the rovings for wrapping upon a reel operating so angled would be more troublesome but would not present too difficult a problem.

In another possible, but likewise unpreferred alternate method, the reel could be held stationary and the coated roving guided around it. The guiding means would be moved lengthwise of the reel as well as around it. In such an installation, it might be advisable to also have the coating device and the spools of roving follow the movement of the guiding means.

Another modification of the invention involves wrapping the coated strands around the reel under sufficient tension and with the resin coating soft enough that each strand and its coating is flattened as it passes over the spacing rods **70**, **71**, **77** and **79**. This flattening extends along the strands away from their actual contact with the rods. With the strands so shaped, the setting of the resin results in bristles of somewhat blade form. When incorporated in a cylindrical brush assembly the broadened sides

of the bristles face the direction of rotation and present a greater area for driving contact with the debris or snow being collected.

Also, different spacing members may be utilized to vary the number and spacing of rows of bristles. The speed of production is another factor that may be altered according to conditions. That given as an example herein in describing the apparatus is lower than would be normally utilized.

Other modifications and substitutions will occur to those skilled in the art without departing from the spirit of the invention and the confines of the following claims.

I claim:

1. A method of making brush segments comprising wrapping successive layers of strand material upon a rectangular reel, separating each layer of such successive layers along the center of the reel as strand material is wrapped thereon, heavily coating such strand material with a settable liquid resin as the strand material is wrapped upon the reel, setting the liquid resin while the strand material is wrapped on the reel, and thereafter removing the thus stiffened strand material from the reel.

2. A method according to claim **1** in which the liquid resin is a polyester.

3. Apparatus for making brush segments including a generally planar, rectangular reel, means for delivering bristle forming strand material and wrapping such material in successive overlying layers around the reel, and rods associated with the reel extending lengthwise between the edges thereof for holding each of such layers apart along the center of the generally planar sides of the reel, the rods being removably fixed in spaced relation to the reel and means temporarily holding brush segment base members on the reel.

4. Apparatus for making brush segments including a generally planar, rectangular reel, means for delivering bristle forming strand material and wrapping such material in successive overlying layers around the reel, and rods associated with the reel extending lengthwise between the edges thereof for holding each of such layers apart along the center of the generally planar sides of the reel, the rods being removably fixed on the reel and spaced a distance greater than the thickness of the layers.

5. Apparatus for making brush segments including a generally planar reel having parallel lengthwise edges, a plurality of pairs of removably mounted rods extending lengthwise on the reel between its lengthwise edges, the individual rods of each pair of rods being located on opposite sides of the plane of the reel an equal distance from the plane, each succesive pair of rods being laterally spaced apart from a first pair of rods proximate to the plane to more remote pairs; and means for wrapping bristle forming material in layers around the reel and rods, one layer of the material being wrapped on each pair of rods, each layer of material contacting its immediately underlying layer along the lengthwise edges of the reel, each layer diverging from the edges to a separation between individual layers at the rods equal to the spacing between the rods.

6. Apparatus for making brush segments as recited in claim **5** where the pairs of rods are disposed substantially midway between the lengthwise edges of the reel.

7. Apparatus for maikng brush segments as recited in claim **6** where the rods are mounted for removal along the length of the reel.

8. Apparatus for making brush segments as recited in claim **7** where the reel is a generally rectangular planar reel.

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GRANVILLE Y. CUSTER, JR., *Primary Examiner.*